

CLAIMS

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5 1. Optical device for focusing a laser beam, comprising:
- a source of emission of a laser beam;
- a focusing lens of the laser beam;
- first means adapted to select a central portion of the
laser beam;
characterised in that said first means are directly applied
on the focusing lens.

10 2. Device according to claim 1, wherein the laser beam is
a substantially elliptic and astigmatic beam.

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15 3. Device according to claim 1, wherein the first means
comprises means defining on the focusing lens an aperture having a Fresnel
number which is smaller than 2 along a fixed reading
direction.

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15 4. Device according to claim 3, wherein said aperture has
a Fresnel number smaller than 1.2 along said reading
direction.

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20 5. Device according to claim 3, wherein said aperture has
a Fresnel number smaller than 2 along an orthogonal
direction with respect to said reading direction.

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25 6. Device according to claim 1, wherein said first means
comprises a coating means made of a substantially opaque
material, applied on a peripheral portion of a front
surface of the focusing lens so as to allow the propagation
of the central portion of the laser beam, and obstruct the
propagation of a surrounding portion of beam.

7. Device according to claim 6, wherein said coating means
are applied on the front surface of the focusing lens faced
on the opposed side with respect to the source of emission.

30 8. Device according to claim 6, wherein said coating means

B are applied according to any one of the following methods: spraying, sputtering, evaporation, printing, painting.

9. Device according to claim 1, wherein said first means comprises a diaphragm having a central aperture adapted to 5 allow the propagation of the central portion of the laser beam, and a surrounding surface adapted to obstruct the propagation of a surrounding portion of beam, the lens and the diaphragm comprising opposed front surfaces, of conjugate shape, adapted to be reciprocally coupled.

10 10. Device according to claim 9, further comprising an adhesive which is interposed between the diaphragm and the focusing lens.

15 11. Device according to claim 1, wherein the focusing lens and said first means constitute a single optical element comprising, in a central portion, the focusing lens and, in a surrounding portion, means adapted to separate the central portion of the beam from the surrounding portion of beam.

20 12. Device according to claim 11, wherein said focusing lens is a diffracting lens made by a diffracting technology.

13. Device according to claim 11, wherein said means adapted to separate the central portion of the beam from the surrounding portion of beam comprises a surface made of 25 a substantially opaque material, which is adapted to obstruct the propagation of the surrounding portion of beam.

30 14. Device according to claim 11, wherein said means adapted to separate the central portion of beam from the surrounding portion of beam comprises a surface made of a diffusing material, adapted to disperse the surrounding

portion of beam.

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15. Device according to claim 14, wherein the surface of diffusing material is shaped according to any one of the following types of lens: divergent Fresnel lens, refractive

5 lens, diffractive lens.

16. Device according to claim 1, comprising means for allowing the optical alignment between source of emission and focusing lens.

10 17. Device according to claim 16, wherein the means for allowing the optical alignment between source of emission

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15 and focusing lens comprises a substantially tubular portion of lens which extends from a front surface of the focusing lens and is adapted to be mounted by interference on a support structure of the source of emission, said substantially tubular portion comprising an inner wall provided with at least two teeth extended in a substantially radial direction and adapted to be housed into corresponding housings obtained on the support structure of the source of emission.

20 18. Device according to claim 17, further comprising an adhesive interposed between the support structure of the source of emission and the substantially tubular portion of the focusing lens.

25 19. Device according to claim 18, wherein said adhesive is a thermally conductive glue.

20. Device according to claim 17, wherein the inner wall of the substantially tubular portion of the lens is coated with ~~means made of~~ a substantially opaque material.

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30 21. Device according to claim 16, wherein the means for allowing the optical alignment between the source of

emission and the focusing lens comprises at least two strips which extend from a front surface of the lens and are adapted to be mounted by interference on a support structure of the source of emission.

B 5 22. Device according to claim 16, wherein the means ~~to~~ ^{for} ~~allowing~~ allow the optical alignment between source of emission and focusing lens comprise a substantially tubular container adapted to house the focusing lens and the source of emission.

B 10 23. Device according to claim 22, wherein the focusing lens comprises a reference notch intended for being positioned in alignment with a visual reference marked on the container.

B 15 24. Device according to claim 22, further comprising a ~~the focusing lens~~ clamping washer adapted to ~~lock in position the focusing~~ ^{lock in position} lens inside the container.

B 20 25. Device according to claim 22, wherein the container comprises an internal guide adapted to cooperate with an alignment slot formed on the focusing lens.

B 27. Lens for focusing a laser beam, ~~characterised in that~~ ^{including a} ~~it comprises~~ coating means made of a substantially opaque material, applied on a peripheral portion of a front surface of the lens so as to allow the propagation of a central portion of the laser beam, and obstruct the propagation of a surrounding portion of beam.

B 30 28. Optical element for focusing a laser beam, ~~characterised in that~~ ^{said element comprising} ~~it comprises~~ a focusing lens and a diaphragm having a central aperture adapted to allow the

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propagation of a central portion of the laser beam, and a surrounding surface adapted to obstruct the propagation of a surrounding portion of beam, the lens and the diaphragm comprising opposed front surfaces, having conjugated shape,

5 adapted to be reciprocally coupled.

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29. Optical element for focusing a laser beam, *said element comprising*, characterised in that it comprises, in a central portion, a focusing lens adapted to allow the propagation of a central portion of the laser beam and, in a surrounding portion, 10 means adapted to separate the central portion of the beam from a surrounding portion of beam.

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30. Apparatus for assembling an optical device according to any one of claims *22*, characterised in that it comprises a support frame for the container and 15 substantially automatic displacement means that are active on the source of emission to position the latter inside the container.

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31. Method for assembling a device according to any one of claims *22* to 25 by means of the apparatus of claim 30, characterised in that it comprises the following steps:

- inserting the focusing lens inside the container till abutment occurs;

- inserting the laser diode inside the container by the displacement means;

- observing the image of the spot caught by a sensor located at a fixed distance from the container, as the laser diode is inserted in the container;

- stopping the laser diode displacement means when the image of the spot observed presents predetermined 30 dimensions and shape;

- fixing the laser diode into position.

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